Unit 2: Part B (Chapter 6)

6.1 Slope of a Line

LESSON FOCUS Determine the slope of a line segment and a line.

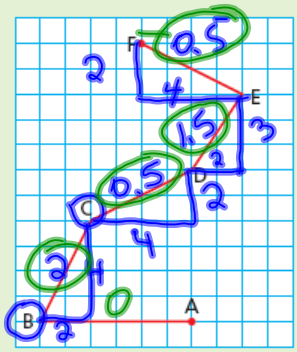
Make Connections

The town of Falher in Alberta is known as *la capitale du miel du Canada*, the Honey Capital of Canada. It has the 3-story slide in the photo.
How could you describe the steepness of the slide?

TRY THIS

Work with a partner.

This diagram shows different line segments on a square grid.



A. Think of a strategy to calculate a number to represent the steepness of each line segment.

B. Which is the steepest line segment? How does your number show that?

C. Which segment is the least steep? How does its number compare with the other numbers?

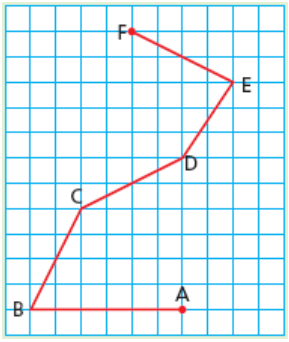
D. On a grid, draw a line segment that is steeper than segment CD, but not as steep as segment BC. Use your strategy to calculate a number to represent its steepness.

E. How are line segments CD and EF alike and different? How do the numbers for their steepnesses compare?

F. What number would you use to describe the steepness of a horizontal line?

$\frac{4}{2}=2$ $\frac{2}{4}=0.5$

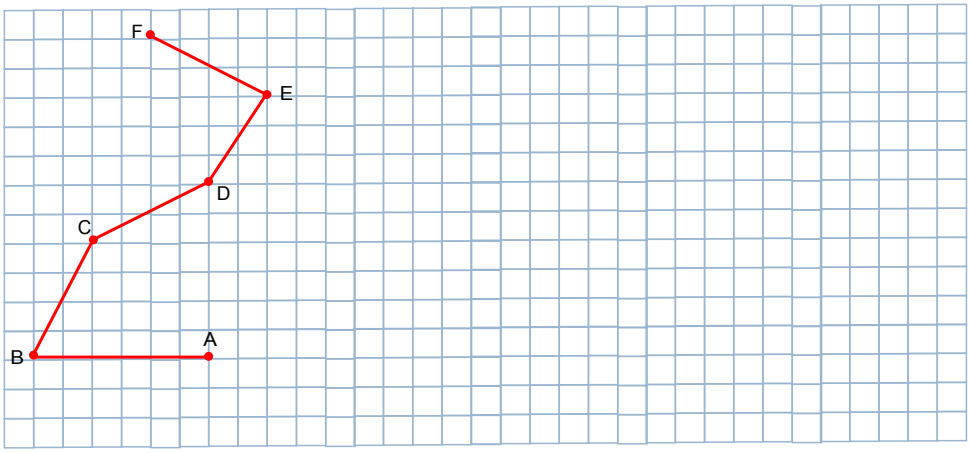
What strategy did you use to calculate a number to represent the steepness of each line segment?



Which is the steepest line segment?
How does your number show that?

Which segment is the least steep?
How does its number compare with the other numbers?

Draw a line segment that is steeper than segment CD, but not as steep as segment BC. What number did you use to represent its steepness?



How are line segments CD and EF alike and different?
How do the numbers for their steepnesses compare?

What number would you use to describe the steepness of a horizontal line?

Some roofs are steeper than others. Steeper roofs are more expensive to shingle.
The steepness of a roof is measured by calculating its **slope.**

$$\text{Slope} = \frac{\text{rise}}{\text{run}}$$

The **rise** is the vertical distance from the bottom of the edge of the roof to the top.
The **run** is the corresponding horizontal distance.
For each roof, we count units to determine the rise and the run.

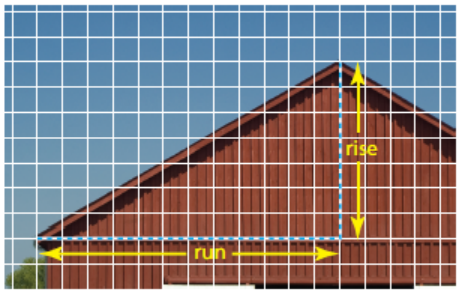
Roof A

For Roof A

$$\text{Slope} = \frac{\text{rise}}{\text{run}}$$

$$\text{Slope} = ?$$

Roof B

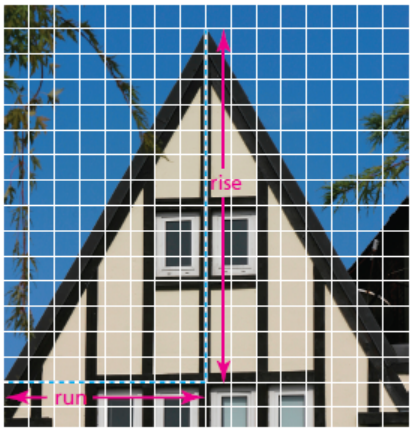


For Roof B

$$\text{Slope} = \frac{\text{rise}}{\text{run}}$$

$$\text{Slope} = ?$$

Roof C



For Roof C

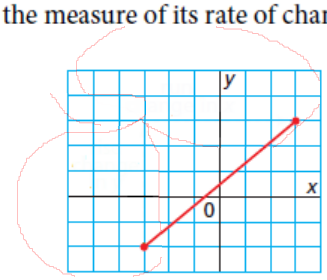
$$\text{Slope} = \frac{\text{rise}}{\text{run}}$$

$$\text{Slope} = ?$$

The slope of a line segment on a coordinate grid is the measure of its rate of change.
From Chapter 5, recall that:

$$\text{Rate of change} = \frac{\text{change in dependent variable}}{\text{change in independent variable}}$$

$$\text{Rate of change} = \frac{\text{change in } y}{\text{change in } x}$$



The change in y is the rise.
The change in x is the run.

$$\text{So, slope} = \frac{\text{rise}}{\text{run}}$$

6.1 Slope of a Line

$$\text{Rate of change} = \frac{\text{change in dependent variable}}{\text{change in independent variable}}$$

$$\text{Rate of change} = \frac{\text{change in } y}{\text{change in } x}$$

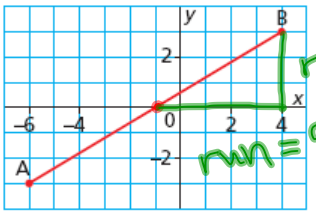
The change in y is the rise.
The change in x is the run.

$$\text{So, slope} = \frac{\text{rise}}{\text{run}}$$

Example 1 Determining the Slope of a Line Segment

Determine the slope of each line segment.

a)

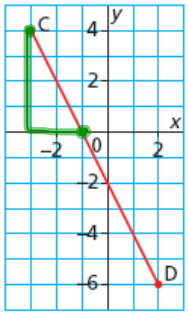


rise = 3

run = 5

slope is $\frac{3}{5} = 0.6$

b)



$\frac{4}{2} = 2$

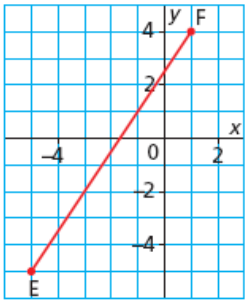
SOLUTION

6.1 Slope of a Line

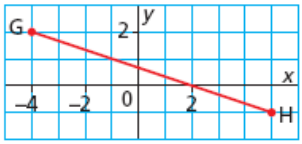
CHECK YOUR UNDERSTANDING

1. Determine the slope of each line segment.

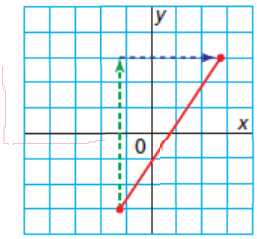
a)



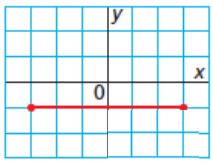
b)



When a line segment goes up to the right, both y and x increase; both the rise and run are ? so the slope of the segment is ?

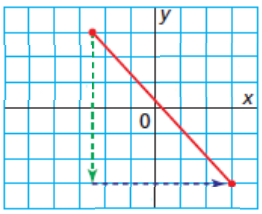


For a horizontal line segment, the change in y is 0 and x increases.
? ?

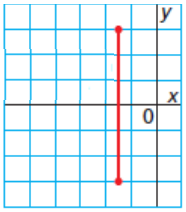


$$\text{Slope} = \frac{\text{rise}}{\text{run}}$$

When a line segment goes down to the right, y decreases and x increases; the rise is ? and the run is ? so the slope of the segment is ?



For a vertical line segment, y increases and the change in x is 0.
?



$$\text{Slope} = \frac{\text{rise}}{\text{run}}$$

?

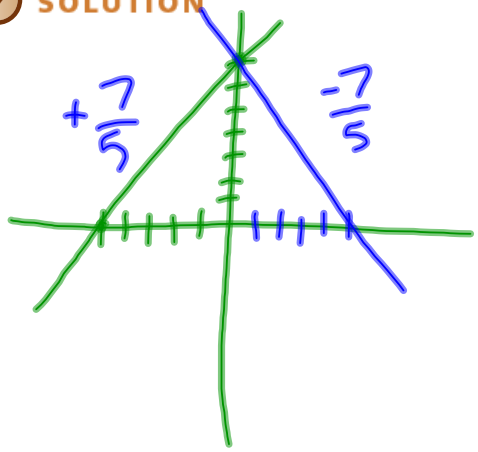
Example 2 Drawing a Line Segment with a Given Slope

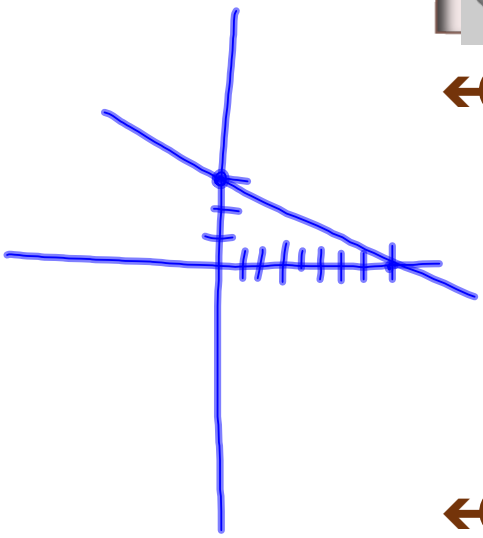
Draw a line segment with each given slope.

a) $\frac{7}{5}$

b) $-\frac{3}{8}$

SOLUTION



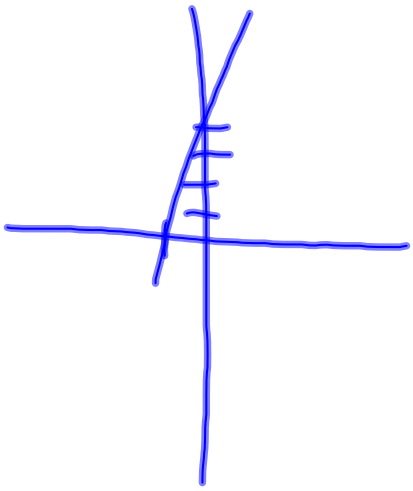


CHECK YOUR UNDERSTANDING

6.1 Slope of a Line

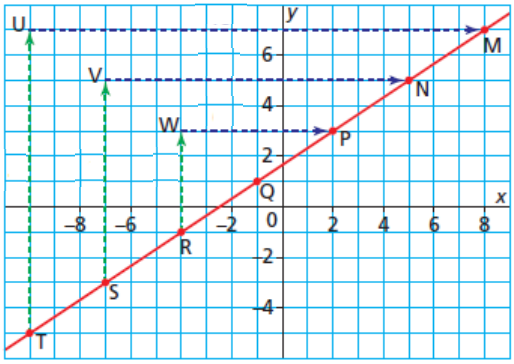
Slope = 4

$\frac{4}{1}$



We can show that the slopes of all segments of a line are equal.
On line MT, vertical and horizontal segments are drawn for the rise and run.
These segments form right triangles.
Consider the lengths of the legs
of these right triangles.

$\frac{TU}{UM} = ?$ $\frac{SV}{VN} = ?$ $\frac{RW}{WP} = ?$



?

Example 3 Determining Slope Given Two Points on a Line

Determine the slope of the line that passes through C(–5, –3) and D(2, 1).

SOLUTION

Slope of a Line

A line passes through $A(x_1, y_1)$ and $B(x_2, y_2)$.

$$\text{Slope of line AB} = \frac{y_2 - y_1}{x_2 - x_1}$$

Example:

Determine the slope of the line that passes through C(–5, –3) and D(2, 1).

$x_1\ y_1 \quad x_2\ y_2$

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - (-3)}{2 - (-5)} = \frac{4}{7}$$

6.1 Slope of a Line

3. Determine the slope of the line that passes through E(4, –5) and F(8, 6).

$x_1\ y_1$

$x_2\ y_2$

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{6 - (-5)}{8 - 4} = \frac{11}{4}$$

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